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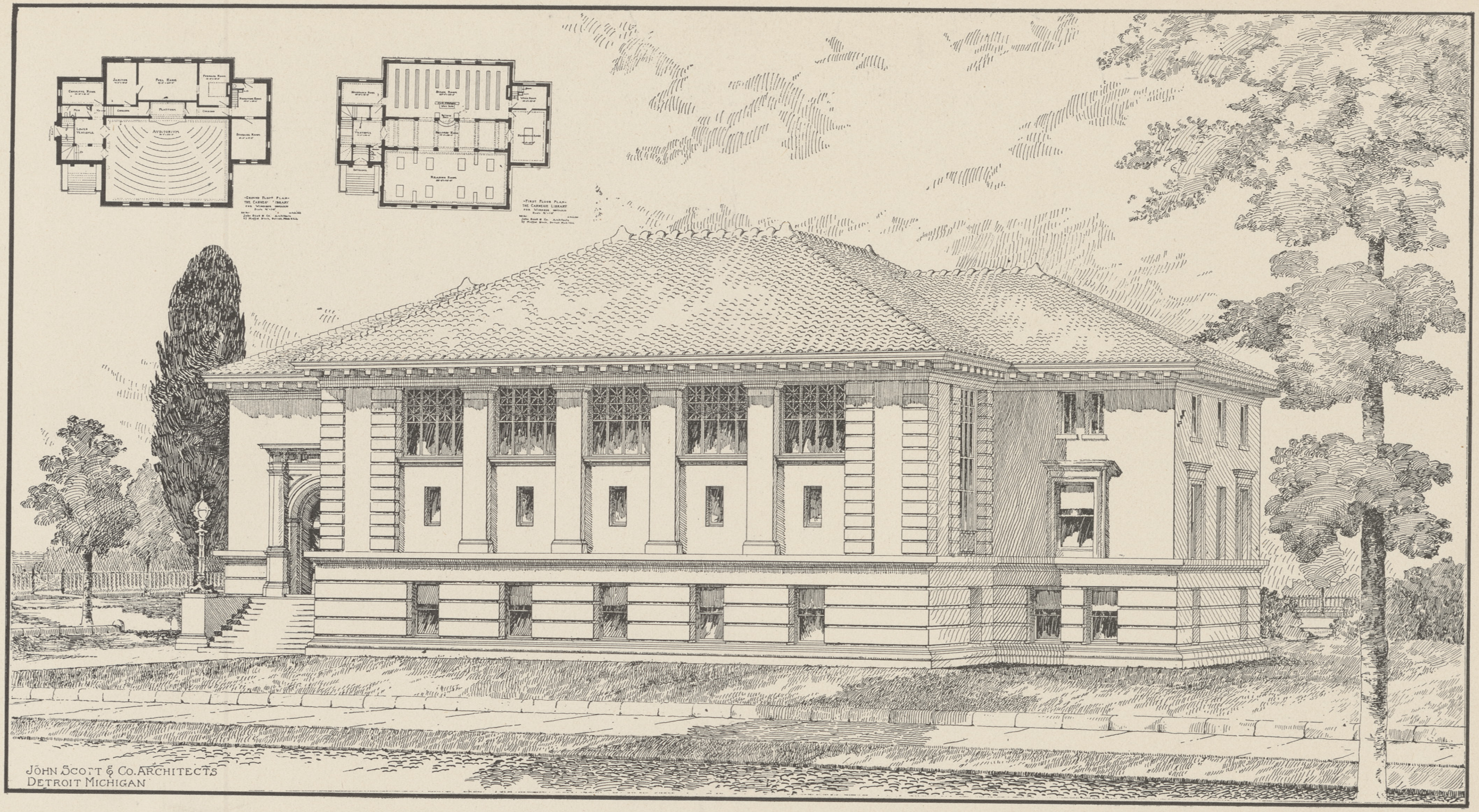

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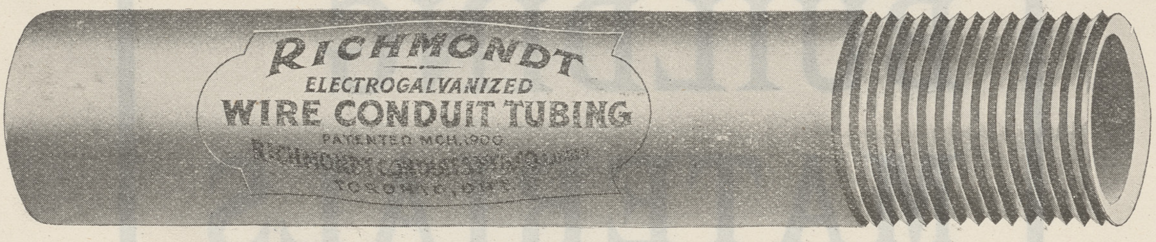

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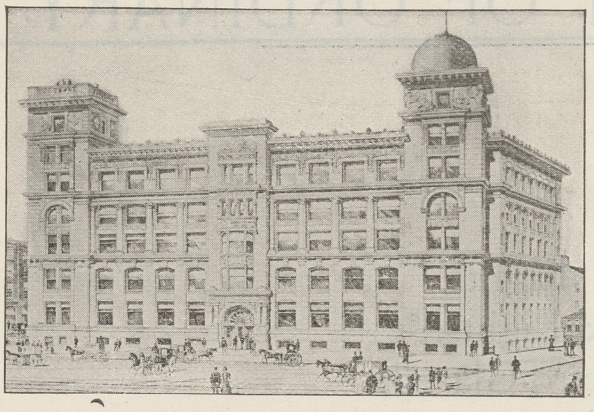

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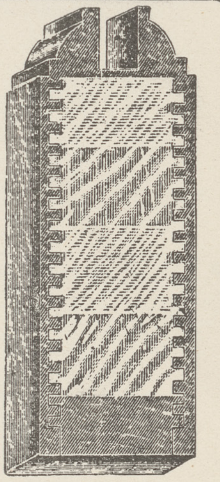

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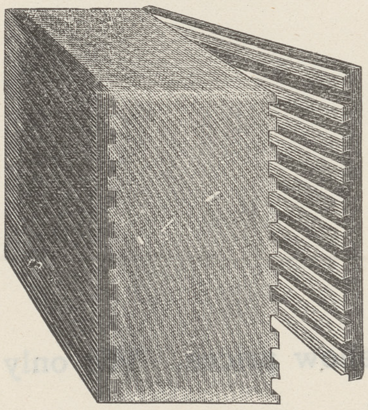

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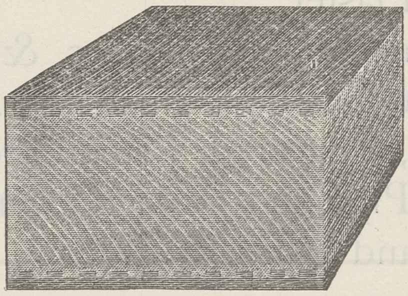

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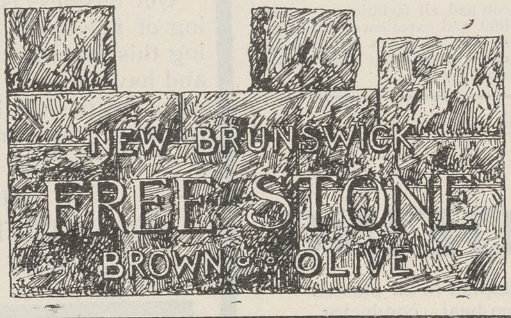

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The Canadian Architect and Builder

VOL. XV.—NO. 174. JUNE, 1902.

ILLUSTRATIONS ON SHEETS.

Proposed "Carnegie" Public Library, Windsor, Ont.—John Scott & Co., architects.
Interior of St. Annes des Plaines church, Que.—J. Venne, architect.
Design for Lectern.—By G. S. Lemasnie.
House at Cold Springs Harbor, Long Island, N.S.—Carriere & Hastings, architects.

ILLUSTRATIONS IN TEXT.

Pair of Semi-Detached Houses on a Narrow Site, Toronto.—F. F. Saunders, Architect.

ADDITIONAL ILLUSTRATIONS IN ARCHITECTS' EDITION.

Two Photogravure Plates.—Residence of Mrs. T. M. Harris, St. George Street, Toronto.—Messrs. Burke & Horwood, Architects.

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" S. H. TOWNSEND, " "
" FREDERICK G. TODD, Landscape Architect, Montreal.
" W. H. ELLIOTT, Toronto.
" J. C. B. HORWOOD, Architect, Toronto.
" A. F. DUNLOP, R.C.A., Architect, Montreal

Photographic Exhibition.

An exhibition of architectural photographs is a dull thing. The photograph is honourably matter of fact, no doubt, and tells no deliberate falsehoods; but it cannot be said, in the fullest sense, to tell the truth. In the first place, of course, the very important element of colour is left out; not only in the building, but in the surroundings which do so much to set it off. In the second place the point of view is limited and the effect from an imperfect point of view is less satisfactory seen through a limited lense than through an adjustable and reasoning eye. The complaint of painters, that people see things not as they appear to the eye but as they know them to be, is not on the whole a bad thing. We may be unperceiving sometimes of the pictorial effects of nature; but for practical purposes when a man is finding his way across the country, for instance, it is of less importance that he should enjoy the effect of a purple patch of shadow in the middle distance than that he should know it means a bridge. In the same way the eye is able to translate perspective back to the facts it represents, and see in an extremely sloping line the effect of a level cornice. But more than this the eye has a way, if it is an intelligent eye, of selecting the most interesting points and ignoring those which are unimportant. A man of taste before a well composed building sees it as it was meant to be seen, with his attention fixed upon the essentials; and if he were to draw it would bring out these essentials. A photographic lense on the other hand is just as particular about the non-essentials; when confronted with a family group, as amateur photographers well know, it seems to devote its best efforts to the wall paper and picture wires. This cannot be called an artistic representation. For artistic representation we want a statement that is like a good story—the points all in, the twaddle all out; and the photograph is too much like an old woman's tale—laying equal emphasis on major and minor points—to satisfy this requirement. As a study in design, a drawing which brings out a little more favourably than can be done in nature the points of the design, is perhaps more profitable than a photograph which tends to overwhelm the points with minor details more than would be the case in nature. An exhibition of drawings is certainly more interesting.

Correspondence Sch ols.

It is somewhat surprising to hear that the Architectural League had anything to say in favor of the Correspondence Schools. They have the merit of marking down a course of reading for the solitary student and giving him a stimulus to carry it out—in great part the stimulus of feeling that his course is costing a good deal of money and he must not throw it away. On the other hand

they have the demerit of calling the course of reading a qualification, which it is not. They advertise in such a way that draughtsmen and builders' foremen think that this is the short road to become an architect. The result is an increase of the unskilled who do not know that they are unskilled, and a neglect of less attractive but more substantial means of training. Time will no doubt disprove the undue pretensions of these Schools, but at the cost of much loss and disappointment to students; and if any professional body speaks in praise of the system there should at the same time be strict recognition of its limitations. There can of course be no question of a Correspondence School as a substitute for the Scientific Schools of McGill and Toronto University, but students should be warned against thinking it a sufficient substitute for the course of study and examinations of the Associations of Architects.

Building Permits. Just how numerous and glaring are the defects of the so-called Toronto Building By-law, is known only to those who like architects and builders have intimate relations with the Building Department. Let us take as example the unnecessary and vexatious regulations governing the issue of a building permit. The Building Inspector's Department will refuse to grant an architect a permit until a receipt is produced from the waterworks department showing that payment has been made for the water which will be required by the contractor in erecting the building. This means that the architect must either take his plans to the water department and wait while the officials figure up from them the probable quantity of water required by the builder, or leave them behind and go or send for them the next day. There is no good reason why architects should be put to all this trouble and delay. If the plans when submitted by the architect are found to conform to the by-law as interpreted by the Building Inspector, the permit should issue forthwith. Arrangements for the supply of water should lie with the water department and the contractor. Advance payment for the water could easily be insured by the city refusing to turn on the water except on production by the contractor of a certificate of payment from the water department.

Architects and Landscape Architects. Mr. Pentecost's paper, read before the Architectural League, points clearly to a conclusion, which he forbore to press, that, when the site of a building is sufficiently important to require the intervention of a landscape architect, he is the paramount designer. Repton, as quoted in the paper, is less modest. "Repton's position," Mr. Pentecost says "is, that while the landscape architect should have no official voice in the actual designing of the house, the style and general arrangement, location and disposition of the house and grounds should be officially determined by the necessities of the landscape architect's general plan; for, as Repton says further, 'to my profession belongs chiefly the external part of architecture, or a knowledge of the effect of buildings on the surrounding landscape.'" All this is quite true. The site prescribes the character of the building; the building aims to be as it were a part of the site; and if the architect is obliged to call in a landscape architect to enable him to understand the possibilities of the site, it goes without saying that he must base his design upon the understanding thus received. This is all Mr. Pentecost spoke for—co-operation. But there is a dark hint lying in his statement that "the true solution of the problem rests with the progress and recognition of landscape architecture as a profession." He goes on to show that there has been hindrances to the development of of this profession—to its development that is to say, from landscape gardening, as it used to be called, to landscape architecture. When fully developed and recognized are we to expect that the landscape architect will rise from being employed by the architect to employing the architect? Will the co-operation, that Mr. Pentecost rests upon, change from an architect inviting the co-operation of a landscape gardener to the landscape architect inviting the co-operation of a house planner? It is the logical sequence. The major quantity fixes the condition for the minor. As the house (that is the architect) fixes the conditions for the supplementary arts of painting and sculpture, so the site (that is the landscape architect) should fix the conditions for the house. But logical consistency is an imperfect guide to life. The house is after all the principal thing. It is more impossible for the landscape architect to grasp the requirements of that problem than it is for the architect to seize upon the points of a site—and take advice from a landscape specialist.

The Education of Architects. THERE is something most praiseworthy in the continual discussion by architects of means for the better education of students, but there is surely something that can be done by architects to educate themselves and each other. The absence of this element from the discussions of architects gives a strange air of unreality to their talk about education. It is of course useless to the cobwebs, and a surprising amount of good feeling talk of set studies, or problems, or prizes for busy architects, but Mr. Bispham Page spoke a bottom truth when he pointed out that an architect learns the best things he knows after he has begun practising; and the question is whether architects would not materially hasten each others' development by a systematic exchange of ideas. Meeting to study problems in the abstract is too laborious and it is school boy work any way; but the study of current problems, which constitutes this post graduate course, which Mr. Page speaks of, which architects are taking all their lives, could be made more profitable and much quicker in operation by meeting other architects systematically for mutual criticism and discussion. The old fashioned jealousy of architects for one another has almost disappeared, under the influence of greater culture; if indeed, in the matter of design, it has not altogether disappeared. There is no reason why it should exist. There is so much individuality in art that however much a man may give of his ideas he will never find that they are taken up by others in the same way he has taken them up. If every one pours freely into the the fund of common experience there will be a gain all round, without increase of conflict, for, though every man takes from it the same material, it will be found worked up into different products. He who contributes most to discussions of this kind will gain the most;

for, by the effort of explaining his ideas, he will clear them up as they never were before. Clear thinking is the fruit of expression, and one reason why it is so difficult to get contributors to professional paper reading and discussion is, that there is so little clear thinking and so much disinclination to the effort of thinking clearly. There ought therefore all the more be a prosperous career for a series of meetings to which members could bring, not their discoveries, but their doubts and difficulties. It is twice as easy to solve a problem in conversation as alone ; and it there is no solution, if the designer is up a blind alley, as so often happens in design, a light from outside is the quickest way to show him where he is. Architects could improve one another incalculably by regular meetings for mutual criticism.

The Durability of the Steel Frame. THE rumour that the pulling down of a twelve year old steel frame building in Chicago has shown its lower columns to be half eaten through with rust contradicts the evidence of the gridiron foundations of the old post office which after a longer term of years, if we recollect rightly, were found to be in good order inside their cement casing. But if this rumour is true, (and doubt is cast upon the preservation of iron in cement), it will be a serious addition to the uncertainty which is felt as to the life of a steel frame building. This discussion has been revived in the American papers and reports of experts are so contradictory that the question may be said to rest in doubt. In the meantime steel frame buildings are being rushed up more than ever and we may be sure that carefulness does not increase with familiarity. Representations have been made of the danger of efflorescent brickwork in contact with the steel frame. If the corrosive salt is as freely efflorescent on the inside as it is on the outside, the wall can hardly be called a protective casing. Is any brickwork in fact sufficient protection to a metal which must be kept trom exposure, not to the weather merely, but to the carbonic acid convyeed in ordinary air. It is possible to blow a candle out through a brick wall, by placing the candle at the small end of a funnel held tightly against one side of a brick wall, while the mouth is applied to the small end of a funnel held tightly against the other side exactly opposite. There must therefore be a continual change of air between the inside and the outside of an ordinary brick wall. How much carbonic acid accompanies the change depends upon the amount detained by the mortar. The affinity of lime and cement for carbonic acid must be taxed by sudden changes of temperature or in a high wind when the change of air in the walls is rapid, and there must come a time of satiation when the mortar can no longer be relied upon to stop the passage of the gas. Brick and terra cotta surrounding a steel frame is supposed to be grouted so as to be impervious to air, but it is doubtful if it can be made so at the best, if we may trust the evidence of tests for the permeability of walls, and there is sure to be much laxity in practice.

On the whole there is not enough certainty about the protection of the steel frame buildings ; but they are being built in greater and greater numbers. It is said that twenty-four millions worth of office buildings have been begun in New York this season and steel frame construction is in progress for uptown buildings also. The centre of commerce has moved up a good deal ; and above that apartment houses grow taller and taller, in the effort to accomplish the end of making the same limited area hold an increasing population. About the time New York is solid with steel frame buildings the catastrophe to the earlier buildings of the kind—if there is going to be a catastrophe—will be due. In view of this state of affairs insurance companies are interested and the question of durability is going to be thoroughly tested by an Experiment Station, established by the efforts of Mr. Edward Atkinson, under the direction of a member of the staff of the Massachusetts Institute of Technology.

THE SECOND ANNUAL EXHIBITION OF THE TORONTO ARCHITECTURAL EIGHTEEN CLUB.

The Toronto Architectural Eighteen Club is to be heartily congratulated on the very successful nature of its Second Annual Exhibition which was held during the last week of May in the Galleries of the Ontario Society of Artists.

The exhibits consisted mainly of photographs, a few pen and ink drawings and some pastels and water colors. The subjects were of remarkable range and variety, for the Architectural League of America was well represented and some fine European photographs were loaned ; Montreal, Quebec and Vancouver all assisted to lend increased interest to the collection.

Some of the photos were chiefly remarkable as photographs, the subjects being scarcely entitled to such excellent reproduction; on the other hand, photography with its inherent defects of perspective, failed to do justice to many of the subjects.

As the exhibition was by no means confined to members of the Eighteen Club, it is to be regretted that so many of Toronto's architects were not represented. Such exhibitions can have none but a beneficial effect, by bringing architects together, brushing away and good fellowship is generated ; it it is good for one to mix with one's fellow men surely it must be still better to associate with fellow workers, to exchange ideas and broaden our views. Every architect to whom the advancement of art is more than a mere phrase should endeavor to be represented at this exhibition in the future.

The real live interest shown by our United States friends in this and similar exhibitions is instructive ; they send hundreds of beautifully framed and mounted photographs from many different points widely scattered over a continent to help out a numerically small Architectural Club in Canada ; their genuine interest in the welfare of architecture and their belief in the good derivable from such hearty co-operation is quite clearly demonstrated, and it is to be hoped that every Architectural Society in the Dominion will emulate this friendly example.

If I may venture to offer a suggestion, I think the interest in the exhibition could be greatly enhanced if small scale sketch plans more frequently accompanied the photos, more particularly of interiors. The soul of a design lies in the plan and if the true value of the design is to be appreciated its plan must be shown or at least indicated.

I cannot make mention of every interesting work as the catalogue, which by the by was rather late in making its bow, contained so much that was admirable. I can only make reference to some of those numbers which appealed most strongly to me: Messrs. Bailey & Truscott, Philadelphia, sent a fine collection of photos of executed work, a quaint "Colonial" Exterior, No 11, and a quiet gabled house with half timbered upper stories, No. 22, being particularly attractive.

It is difficult to judge sculpture from rather small photographs in which both scale and technique are almost lost, but the "Stitch" (in clay ?) of Commodore Bainbridge & Stewart, No. 124, seemed to give promise of much greater interest than the other work shown by H. K. Bush Brown (Newburg, N. Y.), though the group, "Indian Buffalo Hunt," No. 122, shows life and spirit.

Messrs. Cope & Stewartson, Philadelphia, contributed a round dozen of fine photos, every one representing work worthy of their reputation: No. 155, "Entrance to House at Edgehill," is simply exquisite, and No. 157, "Dormitories, University of Pennsylvania, from the Terrace," is a fine piece of transplanted English collegiate building.

Of Nicola D'Asanzo's decorative designs, No. 171, "Ball Room Decoration for W. W. Gibbs, Esq.," is a singularly fine composition. The remainder probably depend largely upon the scheme of co'or, which is of course lost in the photos. "Egypt Awakening," No. 190, F.F. Elwell, is in my opinion far ahead of all the other exhibits of sculpture.

No. 212, "Dining Room, Codmore, Hyland," (H. G. M. Gordon) and Nos. 55 and 56, "Dining Room" by A. H. Brokie, Philadelphia, are specially quiet and reserved.

Nos. 236 to 242 is a series of enlargements admirable in light and shade and peculiarly interesting as illustrative of the American Garden.

"Pantry Fittings," by Messrs. Kennedy & Kelsey, of Philadelphia, is a wonderful little bit of skillful contrivance, and the photo of a Mantel, probably in the same house as the Crystal Palace of a Pantry, is as refined as it is effective.

A good collection of photos of Port Sunlight, lent by Sproatt & Rolph, Toronto, indicate the happy result of several architects all working on similar lines and in sympathetic accord.

No. 295, "Bachelor Apartments," F.M. Mann, with an oak hall, kindly rendered by both architect and photographer.

Nos. 298 to 299, Mewman, Westman & Harris, Philadelphia, seemed to me to be the softest and most beautiful photos in the collection, the play of light and shade about the picturesque half timbered house in the trees being quite charming. For the furniture I can find little good to say. Nos. 317 to 320, C. Rholfs, Buffalo, appears to me to confound subtle simplicity and direct carpentry with sheer affectation and then smothers the unfortunate result with surface ornament, which is not bad in itself but so shockingly ill applied. Some designs of furniture seem to abhor a plain surface even of very beautiful material.

H. W. Weller, Montreal, sends Nos. 405 and 406, "Some Typical English Beauty Spots."

Judging from the bronze work, Nos. 411 to 417, by John Williams, New York, it would seem that funds are not doled out to the architect in the United States in the 10 cents at a time measure that is too commonly the case in Canada; but it is this very point which emphasizes the great difference between United States and Canadian Architecture. The Toronto architect has to exercise a degree of self restraint that his confrere across the border seems to wot not of. Rarely indeed can the Canadian architect let himself go because he has so commonly to solve problems involving the greatest possible return for the minimum outlay, and in Toronto the result is for the most part extremely gratifying, as may be seen by referring to the numerous exhibits of work by the President, which illustrates most aptly how a simple and dignified effect may be gained entirely by means of good lines, careful grouping and clever fenestration; all the detail being thought out and applied with a sparing and subtle hand.

This self command is evident in much of the work of other exhibitors, and the English influence is also very marked in Messrs. Burke & Horwood's lovely little Bible Training School. And the garden front to "Castle Frank" and the Stables by the same gentlemen are delightful.

No. 368 to 376, "House in Queen's Park," by Messrs. Sproatt & Rolph, further illustrates the growing grip that the English influence is taking on Toronto; Messrs. Lever Bros. premises by the same authors emphasizes this fact very successfully.

Nos. 378 to 381 are exceptionally good pen and ink perspectives of Symons & Rae's new University Buildings at Kingston,.

No. 144 is perhaps the most pleasing example given of Chadwick & Beckett's work: E. J. Lennox is represented by some very fine enlargements of photos of his well-known work in the city.

No. 444, "An Artist's House," H. Payette, Montreal, is a pretty French villa such as one sees at Strasburg, for instance.

The impression received from this exhibition is that the influence of the French school is but little felt in Toronto, and that the so-called "Colonial" of the United States which has been so absolutely boiled to rags by ardent caricaturists in Canada as well as in the United States, has little hold upon Toronto. The influence of the modern English school on the other hand has rooted deeply in a congenial soil, and in so many able hands will doubtless greatly thrive in the near future. Toronto has a great architectural future and if the members of the profession will but work together the Queen City will probably give the note to the character of Canadian Architecture.

ROBERT M. FRIPP.

The modelling and carving of an immense frieze on the Stanford University memorial arch, in California, marks the completion of a colossal undertaking in sculpture. The arch is over 100 ft. high and is built of Sau Jose limestone; running around it at a height of 80 ft. is the frieze, illustrating American civilization. The total length of the frieze on the four sides of the structure is 232 ft.; its height is 12 ft. It contains 150 heroic figures in high relief.

INTERCOMMUNICATION.

[Communications sent to this department must be addressed to the editor with the name and address of the sender attached not necessarily for publication. The editor does not hold himself responsible for the expressions or opinions of correspondents, but will, nevertheless, endeavor to secure correct replies to queries sent in. We do not guarantee answers to all queries neither do we undertake to answer questions in issue following their appearance.]

From "Builder :" I have a difficult roof to put on a house which has five gables, and no two gables are of the same pitch. There are valleys, hips and common rafters. What I want is some rule by which I can lay out my rafters, so that the differences in pitch at the junction of the roofs will not make any "bad breaks" in the roof. Any information on the subject will be appreciated ?

ANS.—In replying to this request, owing to not having before us a definite plan of the roof, we can only give a general rule for meeting the problems that will arise in the construction and joining of roofs having different pitches. The following diagrams and explanations cover the whole ground, and will, no doubt, suffice for the purposes of our inquirer. At Fig. 1 we show a plan having different pitches. Draw A B

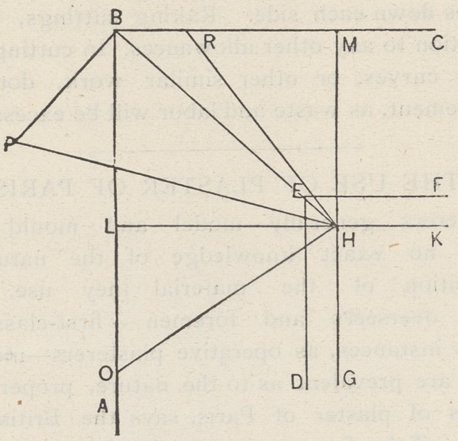


FIG. 1.

and B C, to represent the ridges of the roofs of the main building and wing. Draw E D and E F, representing the outside edge of the wall plate. Suppose E D to be 8 feet from B A, thus representing the half width of main building, and let E F be 7 feet from B C, or in other words, the half width of wing. Draw H C and H D, say 15 inches from E D and E F respectively, to represent the projection of the cornice. Draw H L, H B and H M, respectively the sides of main rafter, valley rafter and wing rafter. From these lines square off the rise, which we will suppose to be one-third pitch, on the main building, equal to 6 ft. 2 inches, as shown by L O, B P and M R. Joining the extremities of these lines with H we get the lengths and plumb cuts of the several rafters.

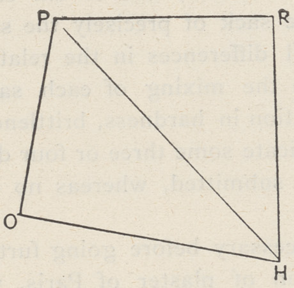


FIG. 2.

Fig. 2 shows the development of the surface. It shows the roof as it would appear if the jack rafter was hinged to the valley rafter and the whole flattened out.

Draw H O and H R, representing the lengths of main, valley and wing rafters, and P R and P O the seat of main and wing rafters, then the angles O P H and R P H give the horizontal cut for jack rafters on main and wing sides of valley respectively.

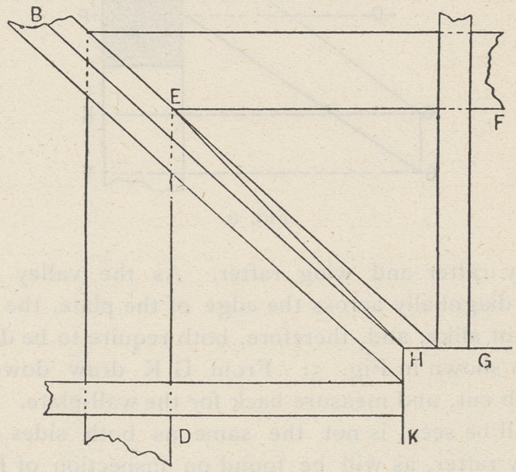


FIG. 3.

Fig. 3 shows the plan of a portion of the roof at foot of rafters on a larger scale. The letters in this figure correspond with those used in Fig. 1. On each side of the line B H draw a line parallel with it, and supposing the valley rafter to be 3 inches thick, make the distance between the lines 1½ inches. Join E H.

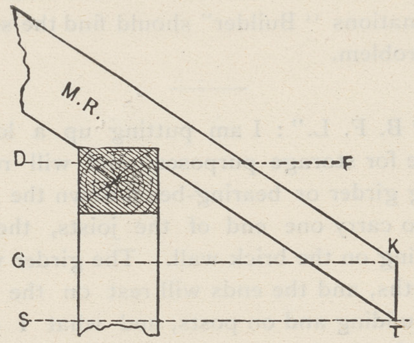


FIG 4.

It will be seen that the valley rafter does not fall directly over the corner of the plate. The joint in the soffit or planceer lies directly under the line E H ; therefore in backing the underside of this rafter or triangular piece comes off of the wide side and a trapezoidal piece off the main side.

Referring to the construction of the roof, it is sup-

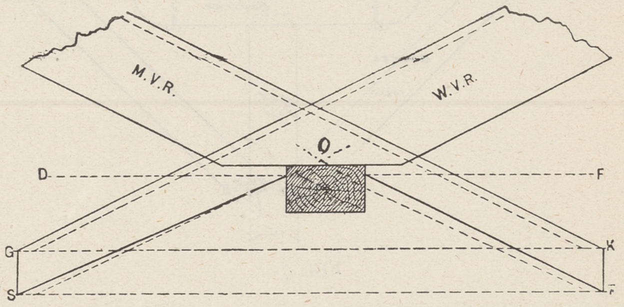


FIG. 5.

posed the valley rafter is three inches thick, or it may be made of two pieces 2 inches thick and spiked together, which would make a better job, and could be backed better.

Figs. 4, 5 and 6 show the side elevation of rafters, and corresponding letters in the several figures refer

to the same parts. Draw the dotted line G K, see Figs. 1 and 3, which represents the line of upper edge of bottom end of rafters, and upon it, at the proper angles shown in Fig. 1, draw the line of main rafter,

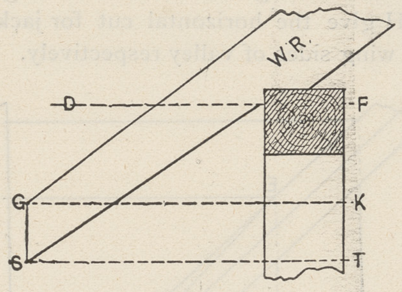


FIG. 6.

valley rafter and wing rafter. As the valley rafter runs diagonally across the edge of the plate, the sides are not alike, and, therefore, both require to be drawn; all as shown in Fig. 5. From G K draw down the plumb cut, and measure back for the wall-plate. This, it will be seen, is not the same as both sides of the valley rafter, as will be found on inspection of Fig 3. Size down the main rafter (see Fig. 4) as required, and through the intersection of the underside, with wall-plate and end cut, draw dotted lines D F and S T, by which corresponding points are to be located on the other rafters. The dotted lines shown in connection with the valley rafter in Fig. 5 shows the barking, and the barking of the underside lies in the intersection of the dotted lines K O and G O. From these diagrams and explanations "Builder" should find the solution of his roof problem.

From "B. F. L.": I am putting up a long brick warehouse for storage purposes, and will require to run a long girder or bearing-beam down the centre of building to carry one end of the joists, the end of joists resting on the brick wall. The girder will be in three lengths, and the ends will rest on the two end walls of building and on posts, and what I desire to know is of a good method to scarf the ends resting on the posts, the posts of corner to have faces on each side framed into the girders.

ANS.—If your timber is long enough to lap over and beyond the posts, a good method of scarfing is shown at Fig. 7. This is simple and not very expensive. A

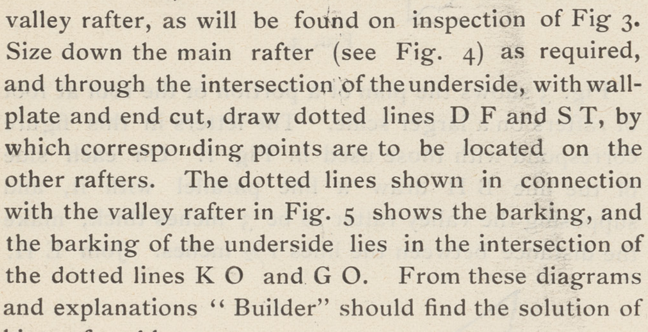


FIG. 7.

better method, indeed one of the very best methods of scarfing, is shown at Fig. 8. In this case the post is framed into a hardwood cap or bolster, the latter being equal in width to the girder and should be from five to six feet long and be fitted into girder as shown and bolted with ¾-inch bolts. This scarf may be depended upon to carry all the weight the girder can sustain.

From "Contractor": How is slating measured?

ANS.—Slating is measured by the square. Allowances are made as follows: Eaves for double crowns, half the length of the slate + 1 inch; above nail-holes,

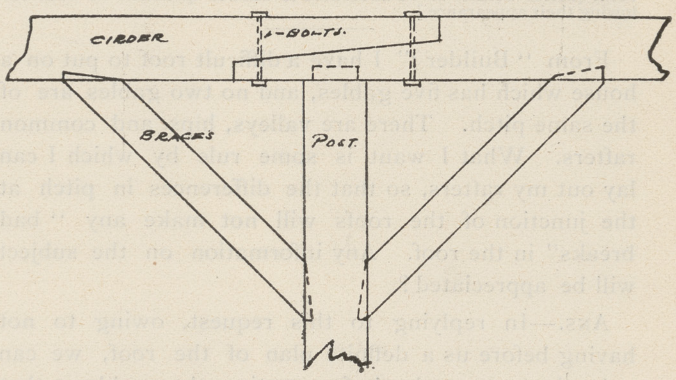


FIG. 8.

that is, for counters slate, 11 inches would be the width by which the dimension is squared (half 20 in. = 10 in. + 1 in. = 11 inches). Hips and valleys, 6 inches on each side, cutting around skylights, scuttles and chimneys or other like projections, 6 inches down each side. Raking cuttings, 6 inches in addition to any other allowances. In cutting around circular curves, or other similar work, double the measurement, as waste and labor will be excessive.

THE USE OF PLASTER OF PARIS.

Plasterers generally—model and mould makers —have no exact knowledge of the nature and composition of the material they use. Even among overseers and foremen — first-class men, in many instances, as operative plasterers—most hazy notions are prevalent as to the nature, properties and qualities of plaster of Paris, says the British Clay-worker. Take five or six samples of plaster to the average foreman, leading man, or mould maker for his opinion, with reasons for same, on the respective qualities of each sample submitted. He will note the colour, the degree of fineness, together with the conditions and effects observed in the mixing and setting, and, finally, the degree of hardness—by scratching, and for brittleness—by snapping pieces off with thumb and finger from small test slabs or tiles run for the purpose. In some cases an attempt is made to get, roughly, at the expansion or contraction; in any case the operator will deduce his opinion of the respective qualities of each sample from observations turning on the methods given above. It is obvious that the observations from their very nature can be founded on no established physical or chemical fact. Indeed, under certain conditions the information afforded may be absolutely misleading. For instance, five or six samples may be taken from one sack of precisely the same quality all through; small differences in the relative qualities of water used in the mixing of each sample can give sufficient variation in hardness, brittleness, and expansion, as to indicate some three or four distinct qualities in the samples submitted, whereas no real differences should exist.

It will be necessary before going further to explain the composition of plaster of Paris, with attending chemical and physical facts, for the due understanding of the subject matter under discussion. Raw gypsum, or fully hydrated sulphate of lime, has the following

formula $CaSO_4 2H_2O$. In other words, in 172 lbs. of this material there are 30 lbs. of water, or 20·9 per cent. water. This water may be driven off by heat, wholly or in part, in accordance with the temperature attained. In the manufacture of plaster of Paris it is the object of the manufacturer to drive off sufficient water from the raw gypsum to give the following formula: $2CaSO_4H_2O$. In other words, 290 lbs. of the manufactured plaster of Paris should contain but 18 lbs. of water, or 6·2 per cent. water. The lowest temperature at which gypsum may be burnt for its conversion into plaster of Paris is 80°C., but temperatures falling between 110° and 120° give the best results. At 200°C. gypsum loses all its water, becoming what is technically known as dead burnt, when it is useless for the work. It is thus seen that in converting crude gypsum (specific gravity 2·31) into plaster of Paris (specific gravity 2·7) practically three-fourths of the original water, which exists in some state of chemical combination, is driven off. And, conversely, this same amount of water is taken up when the plaster of Paris is mixed for running moulds, etc., at the plasterer's hands, on its reconversion into gypsum. But the query not unnaturally arises—why does plaster set? The answer is by no means generally known. It is because plaster, $2CaSO_4H_2O$, is soluble in water; but the additional water taken up gives rise to the insoluble hydrate $CaSO_4 2H_2$, which immediately crystallises out, the plaster when set being a vast network of thousands upon thousands of these crystals. In practice water is used in large excess in order to give the necessary fluidity to the plaster; but this makes no difference in the end, in so far as the amount actually taken up and used in the conversion of the plaster into the fully hydrated crystals is concerned; any water over and above this is simply evaporated in the drying.

Here, then, is a ready method at hand, which has the advantage of being based on exact scientific data, for getting at the true value of any sample submitted. This particularly in conjunction with the specific gravity, which presents no difficulty, since a neutral medium, in the way of a solution, of the specific gravity required, could be readily obtained at little cost from any wholesale chemist. In such a solution the plaster should neither float on the top nor sink to the bottom of the test glass or tube, but just remain suspended in the body of the liquid. This would confirm in many ways one's experiments and observations on the water test. Apart from any degree of fineness in size, plaster may be underburnt. In this case the extent of the damage would be shown by the lower percentage of water absorbed, and since the density would be inferior, the plaster would float on the top of a liquid standardized at 2·7. In the case of over-burnt plaster, we should get inferior absorption and superior gravity. The presence of lime would be indicated by a superior absorption, with corresponding differences in the specific gravity, while the presence of silicious matter would immediately place the combined water and the specific gravity respectively out of agreement. The superior absorption of water by plaster of Paris when lime is present—with evolution of heat, by the way—is explained by the fact that 56 lbs. of lime, CaO, combines with 18lbs. of water; H_2O giving 74lbs. of the slaked lime; $Ca(OH)_2$ a body containing 24·3 per cent. of water, 3·4 per cent. higher than gypsum. The following trials, conducted by the writer, will serve to show how constant is the combination:—

FINE PLASTER.

8 ozs. of plaster plus 5½ozs. of water. Weight after drying, 9¼ozs. full.

8 ozs. of plaster plus 6 ozs. of water. Weight after drying, 9¼ozs. full.

8 ozs. of plaster plus 6½ ozs. of water. Weight after drying, 9½ozs. bare.

Approximately the water taken up in each case was 14 per cent. Theory demands 14·7 per cent. Error 0·7 per cent. This was effected with slight expansion of the plaster.

COARSE PLASTER.

8 ozs. of plaster plus 7½ozs. of water. Weight after drying, 9¼ozs.

8 ozs. of plaster plus 8 ozs. of water. Weight after drying, 9¼ozs.

8 ozs. of plaster plus 8½ozs. of water. Weight after drying, 9¼ozs.

Water taken up and fixed 13·5 per cent., or 1·2 per cent. less than theory demands. The shrinkage in each case was ⅛ in 13 inches.

The three following trials were made with fine plaster, that which had been shown as being practically pure—taking up 14 per cent. of water, but with lime added in varying porportions:—

FINE PLASTER PLUS LIME.

A. 8 ozs. of fine pla ter plus ½oz. of lime and 6 ozs. of water.

B. 8 ozs. of fine plaster plus 1 oz. of lime and 7 ozs. of water.

C. 8 ozs. of fine plaster plus 1½ozs. of lime and 8 ozs. of water.

After mixing, setting, and thoroughly drying the samples were weighed. A had gained 1½ozs., B 1¾ ozs., and C 2¼ozs. In other words, the percentage gain in each case was:—

A = 15 per cent. B = 16·2 per cent. C = 19·1 per cent.

Some relation is thus seen between the amount of water fixed and the proportion of lime present in the plaster. It will be further noticed that the amount of water used in mixing does not affect the results after the plaster has thoroughly dried. But it does affect the plaster in other directions. A larger mass of plaster is obtained for a given weight of the material, when water is used in excess, than is obtained from the same weight of unmixed plaster if water be sparingly used in the mixing. But in the former case the resulting mass will be more open, as a body, and softer than when mixed under the latter circumstances, all other conditions being equal. An explanation of this fact is to be found in the rate or speed of setting. It is well known that the size of crystals, not the shape, is largely governed by the rate or speed of formation in the mother liquid, and since the setting of plaster consists solely of the formation and deposition of crystals in the manner indicated in the earlier part of this paper, the chances are that they are all governed by the same laws. In conclusion, it should be stated that the foregoing experiments were conducted in a workshop with ordinary balances and weights. The many nice adjustments and the absolute accuracy of the laboratory are not, under the circumstances, possible. However, the experiments are sufficiently accurate for all practical work.

WEATHER-TIGHT WINDOWS.*

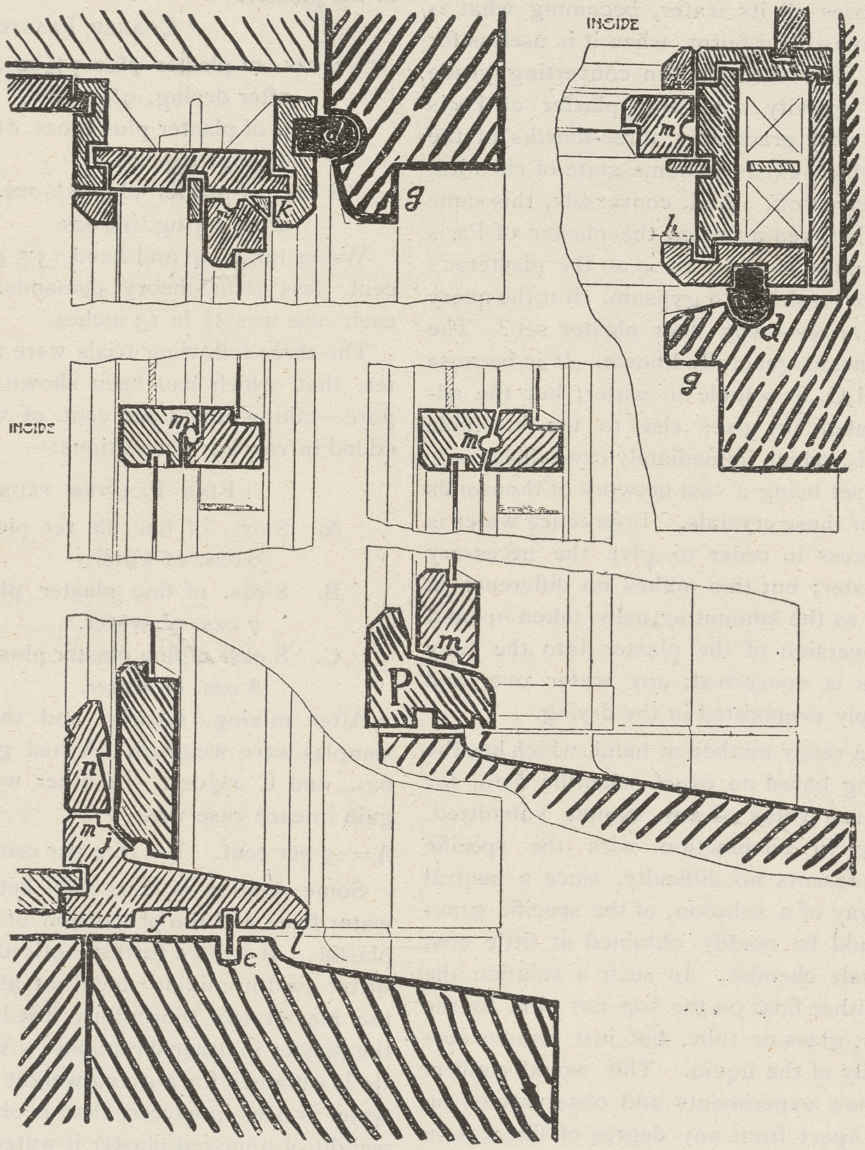
By B. M. Ward.

Which are the best methods of preventing windows leaking (water and air) under strong and prolonged pressure of wind and rain ?

That is the subject of my paper, which is not meant to instruct you, but to draw out the ideas and opinions of those present. I want to know what is to be done to keep a window weather-tight under the most extraordinary conditions.

In the first place let us consider the junction of the frame and the brick or stonework at the jambs, head and sills. Bed the frame in hairmortar, you say. Is this sufficient, especially if the bedding is not very well built ? It is very difficult to bed a frame really well. Moreover, under the varying temperatures, this bedding draws away either from the frame or from the brickwork (or stonework) ; little cracks occur ; then in a big storm the wind, if prolonged, will force water through, and the trouble has begun.

Put a weather-bar between the sills (see e e e, sheets A, B, C) ? Good : but what about the jambs, to say nothing of the head ? Here crops up the question as to whether the window frame should be fixed in front of, or behind a reveal. In this there is plenty of food for discussion. I leave the meal to you.



Sash Windows--Sheet A.

I have not seen the idea exploited, but it seems to me that a metal tongue for stone, or a cement roll for brick, terra cotta or concrete, would be a good thing (d, d, d in sheets A, B and C). In my opinion the weather side or metal bar or cement roll would be better exposed to the weather and air (A and B ; d), and I think the same would apply to the sill weather-bar (B and C) ; even if the bar or roll were omitted, the mere grooves would be helpful as "air hollows." This arrangement of the bar or roll would be of very little value if the frame were in front of a reveal. I have also shown a further groove in the solid frames (f f f, A, B and C), and this serves a double (or triple) purpose. It forms an emergency air-cushion, preventing the further ingress of forced air ; it exposes more of the frame itself to the air and so lessens the chance of rotting ; and thirdly, by its use less of the girth of the frame comes in contact with the bedding, itself an inducement to rotting ; moreover in this connection the smaller the amount of contact between frame and bedding the better the chance of the bedding being made even and homogeneous.

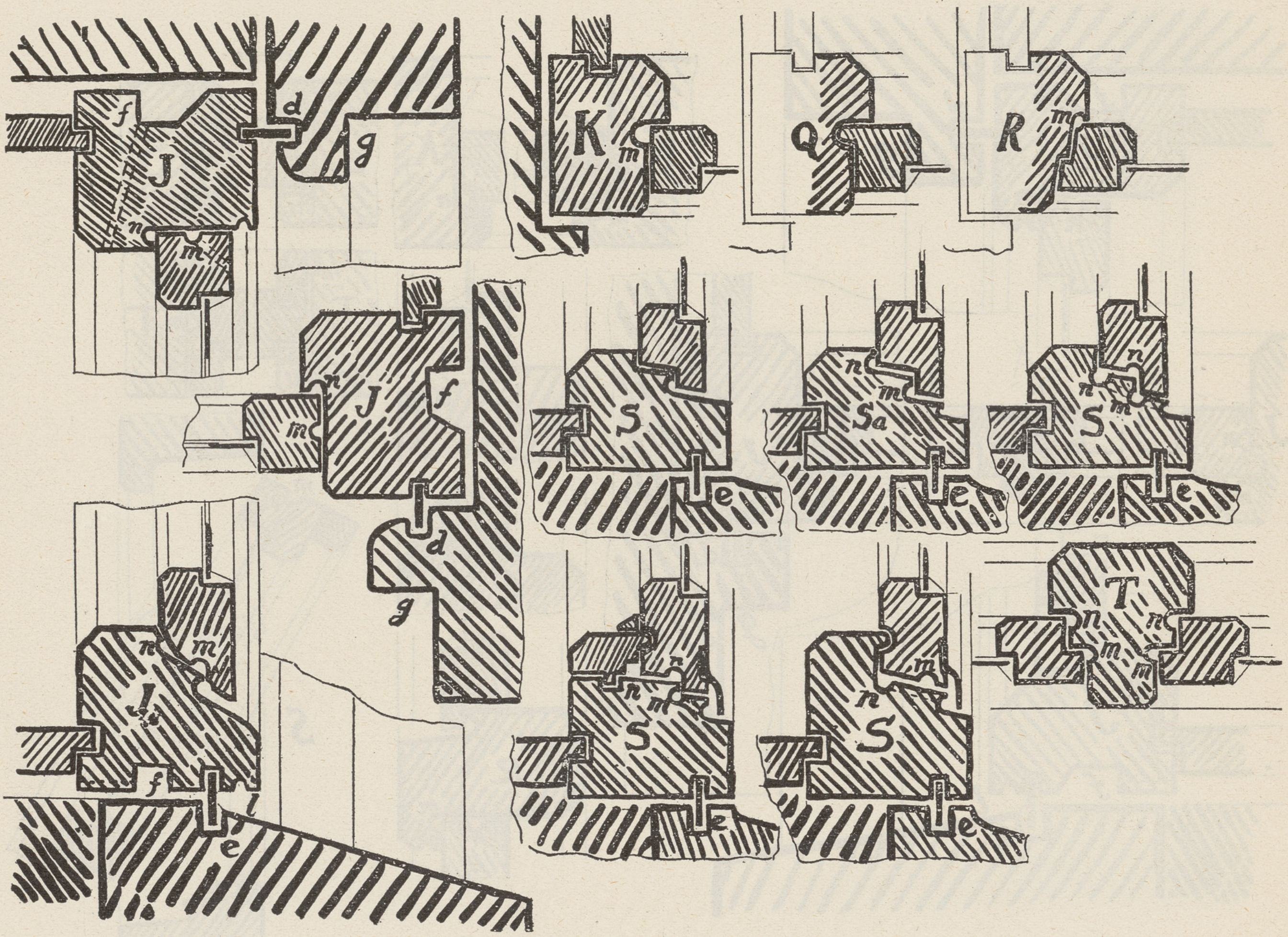
I have also shown (g g g, A, B and C) "the breakwater feature" of Mr. Campbell Douglas, advocated in an article of his on "Specification." I have slightly modified it. Mr. Douglas maintains that the fury of the storm will expend itself on this fillet, and only a

* A paper read before the Liverpool Architectural Society on March 3rd, 1902.

weak edition will be left to tackle the joint between frame and brickwork. Moreover, I have shown in most cases the frame-sill throated and projecting over the stone sill, the weathering of which is taken back behind that throat (l, l, l, A, B and C), another suggestion by Mr. Douglas.

To come, now, to the different types of windows. First, sash windows. These, as generally constructed, keep out the water fairly well, but for incessant rattling in a wind, just when you want to go to sleep, nothing can compete with a sash window. The sashes have shrunk in thickness, and there is now unnecessary space for them between parting slip and lining or bead. Slips of oak, or felt or leather (h h, sheet A) fixed in an existing window might stop the rattle. If they did, they would prevent the sashes being opened, so you

But all this means a window shut tight—an abomination at least in a bedroom. However, fairly large slots in the meeting-rails, which could be closed with little shutters, might be adopted. I have shown a great number of "water hollows" (as they are called; "air hollows" would be a better word—m, m, m; A, B and C). These help considerably in keeping out draught and the weather generally. Any wet that gets to them is carried down at once in the case of jambs, gets down as soon as it can in the case of sills, while in the heads it slips out of the holes drilled for that purpose. The greater object, however, of these hollows is the air-cushion which they form. This prevents forced air from making any progress. Those air hollows marked n, n, n on sheets A, B and C are emergency hollows, so that in case of bad fitting the winds that



Casement Windows Opening Out—Sheet B.

might as well screw the sashes up altogether. However carefully the sashes are made, however well-seasoned the wood may be of which they are made, either they will rattle or they will not slide (at least after rain). The great thing is to press both sashes tight against the parting slip. It struck me the other day that the slope of the sill would help the lower sash to hug the parting bead if the sash could be constantly pressed down, and the slope made steeper than usual (j, A); similarly a fillet (k, A) in the head would help the upper sash if constantly pressed up. All we want, now, is a wonderful fastener which will, at one and the same time, push down the lower sash, push up the upper sash and pull the meeting rails tight together. Whether these particular sections of bead and sill are valuable or absurd, the type of fastener I have described would be a useful addition to any existing window.

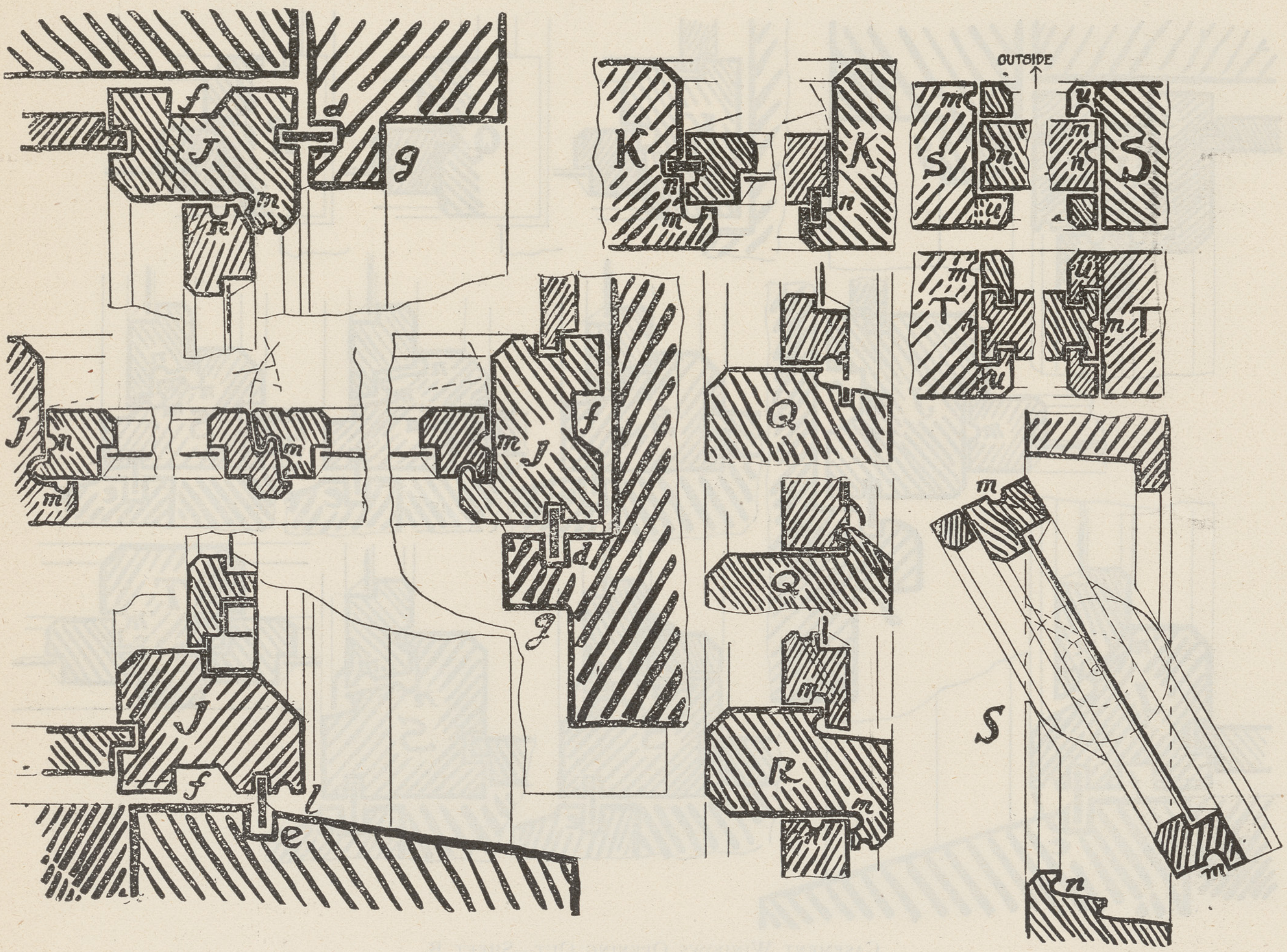
escape through "m" may be stopped by "n."

I have shown two different sections of sill in sheet A. That marked P is Mr. Campbell Douglas's section. He says the wide still, usually prescribed, is very liable to rot; will only allow a very gradual slope unless it is consideraby deepened; that the wet remains on this gradual slope in a wind, and blows up under the sash; that the wide bedded portion all unventilated is conducive to rot; that the weathering of the stone still under and behind a throat in the frame sill is a great improvement, and so on. He says, too, that he finds there is no need to stay the outer parts of the feet of the jamb-boxes. All this is very true, I think; but Mr. Douglas does not say how he stops the feet of the jamb-boxes, to prevent them rotting in their most susceptible part. I have shown a block under the feet, though I do not think it would answer very well; so I rather suggest

the other sill which provides little more contract with the bedding. This would be better, to my mind, if the weather bar were exposed (as in b and c). The tall fascia in front of the bottom rail allows, of course, the bottom sash to be raised for ventilation through the meeting rails, without causing draught below. The shape of the fascia provides an emergency air-cushion at n, and lessens the risk of the fascia and bottom rail sticking together.

So much for sash windows. Of casement windows with the lights hung at the side and opening out, there have been suggested so many sections of the bottom rail and sill, and so many plans of jambs, most of which have their good points, that it is difficult to know which is the best. That marked j,j,j on sheet b seems to me to be good enough. There is little doubt that rebated in order to make a really satisfactory arrangement. Here I may mention that before writing this paper I thought it would be a good thing to get the opinions of some of the local joiners and contractors on the whole subject of weather-tight windows. I therefore wrote to five or six prominent firms, but only received replies from two. One said they could give me no information; the other, Messrs. William Tomkinson & Sons, were good enough to send me a pamphlet on Elliott's fitting to wood casements opening in, saying that they had always found them satisfactory.

In the section of sill marked j (sheet c) I have shown Elliott's metal channels, for I cannot think of anything better. It would be unpleasant for anyone to lean the elbow on them if thinly clothed, but otherwise they would be very satisfactory. Between the jambs marked



WATER-TIGHT WINDOWS—SHEET C.

rails in a casement would be a great advantage if they could only be made quite certain of fitting well to the frame and yet without danger of sticking. In this case (jjj) there is always an emergency airhollow, n,n,n; k is a usual section; q can only be applied to the hinged side, of course; k would do for the other; r would be good if the fitting could be guaranteed—the splays lessen the chance of sticking; k,q and r are all copied, and so are the sills marked s, of which s a seems about the best. The mullion t is also copied, and looks satisfactory, though I personally should always feel afraid of the rebates. All these details (sheet b) would equally apply to a fanlight hung at the top, except that q could only be the head.

Wood casements hung at the side and opening in are more difficult to make weather-tight. It seems necessary to call in the use of metal in some shape or form j I have shown a plan of hooked meeting-rails; the right-hand jamb has obviously no connection with these meeting-rails.

K,K are plans of jamb for one window with metal bars. These would be very satifactory if well fitted. q,q are sections of sills often used, and here copied.

For fanlights hung at the bottom, the left-hand jamb (the hinged side) of j and k would not apply, but the other jambs and heads would; and for the bottom rail that on the transom r would, I think, do well enough.

Fanlights hung at the centre (horizontal centre) can, I suppose, never be made quite weather-tight, especially at the centre; s and t show ordinary method. It is better, if you must have a fanlight hung at the centre, to have it of iron, as there is then less unrebated portion at the centre.

In the plans of jambs, s and t, I have shown the beads

n,n solid on the jambs; a joiner would much prefer these to be planted, but I think it is worth the extra expense to have them solid.

With regard to casements revolving at their vertical centre, Captain Chaddock has very kindly brought his model here. There ought to be the making of a really weather-tight window in this invention, though it is really intended for a bulkhead door in a ship. The window need not revolve on its exact centre at all; it can have the greater part to go out, or to come in, and also can be swung back into the room, the reverse side in, so as to be cleaned with safety.

With regard to iron casements, I only want to ask how long they will keep weather-tight. The manufacturers invite you to play a fire-hose on one of the windows and guarantee there shall not be a drop of moisture inside as a consequence. But this is with a newly-fitted window. I want to know how weather-tight they are after they have been slammed many hundreds of times and after they have been subjected to the extremes of temperature for say twenty years.

I have touched on most of the varieties of windows usually specified, and I am not going to speak of any other kinds.

The general arguments against nearly every section and plan I have advocated are complicatedness and expensiveness. With regard to the former, the golden rule that the simplest is the best seems not to apply here at all. Simple splays and simple joints will not do the work required when under the severest conditions.

With regard to expensiveness, I have purposely had no regard for expense. We want to know what is the best; we already know what is the cheapest. Still it does seem absurd that we should have to be always hacking out little air-hollows here, there and everywhere, and inserting little medal tongues and channels, and always we are fearful that the joiner will not make a perfect fit, or if the fit is perfect at first we know that the wood will shrink if it has not been well seasoned, or worse still, we know that if it has been well seasoned it will swell in wet weather.

Yet another point. I have so far spoken of "weather" either as wet or as draught. There is a third feature of weather—temperature. A window ought to keep out the cold and keep in the heat. Make your window never so water-tight, never so air tight, one thickness of glass will not keep in the heat or keep out the cold; not even plate glass ¼in. thick.

While preparing this paper I have come more and more to the conclusion I arrived at years ago, that this country of ours, with its "climate of samples," requires the almost universal adoption of double windows: double casements or sashes, with single or double frames. In Canada, I believe, they go further; they screw up their double windows inside and out during the winter, and provide for the ventilation (or perhaps they don't) by other means.

With double windows simple details will be quite good enough; the space between the sheets of glass is a splendid air-cushion, stopping wind coming through, and as for the heat and cold I suppose there is not a better non-conductor of heat than a mere layer of air. I am told that two sheets of glass with the air between them are as efficient as a 9in. brick wall, and that a single pane of glass has rarely 25 per cent. of that efficiency. As regards light two clean panes of glass stop less light than one dirty pane; though that is not meant for an argument. I ask you, finally, are not double windows the best of all; and if not, why not?

DAMPNESS IN WALLS.

A correspondent of Indian Engineering, in writing on this subject says: Wet subsoil and rain water are the two causes that account for dampness in walls. These two causes have been found to operate both conjointly and separately. They affect surface as well as the heart of walls. Dampness due to wet subsoil first affects the heart of walls, and working upwards afterwards manifests itself on the surface, but that due to rain water may be found either confined to the surface or in the core of the wall, or both.

Saltpetre on walls is the result of the action of damp on the salts that enter into the composition of the bricks and mortars forming the walls and that of dry air. During wet weather the salts in the bricks and mortar become dissolved and appear on walls in fine white crystalline powder during dry months. The action of saltpetre is not only to produce unsightly patches on the surface of walls, but it also disintegrates bricks and mortars, detaching them in fragments to their ultimate danger and damages properties and furniture in contract with them.

Having said what I know about the causes and effects of damp and saltpetre, I next proceed to impress upon the reader the importance of examining the walls with a view to trace out the source of the evil before suggesting remedies for it. It is very important to find out whether dampness is due to wet subsoil or beating of rain water or rain water from the roof finding its way into the body of the wall through leaks between parapet and roof, before hitting upon the proper remedy. For this purpose the wall should be stripped of the plaster where it is affected. If the look of the bricks is not indicative of damp, a nail should be inserted into the affected portion and watched for a week. If it shows saltpetre it is to be concluded that the heart of the wall has been penetrated by damp, and the bricks being free from sulphates and chlorides do not show signs of decay and that the plaster has been only attacked as the mortar (sand and lime) contains salts. In case damp is found to progress upwards from the plinth to the ceiling it is certain that it is caused by wet subsoil, and in exposed situations it is favoured by rain water beating against it and sometimes it enters the wall in the shape of rain water from the roof.

The principles that underlie the several inventions are (1) to render the walls impervious to rain water or damp; (2) to provide an outlet for damp in the wall and secure a thorough ventilation over the outlet; (3) to use materials that are free from salts. I should add that in case dampness is found due to wet subsoil, it can be best removed by providing an efficient drain for subsoil water if it is found economical and possible.

For new buildings under construction it is found very economical and effective to use damp-proof course over the sectional area of the wall on the plinth, where dampness is expected from wet subsoil. In new buildings caution is also exercised in the selection of bricks and mortar. But in old buildings, exposed to damp from underground, it is not advisable to cover the wall with imperious conposition. There are many petrifying compositions meant to render the walls impervious to damp, but they are of no use where dampness is due to wet subsoil. I am convinced that the second principle is applicable in such cases, i.e., to provide an outlet for damp and to secure a thorough ventilation over it. In new buildings under construction a course of perforated bricks over the plinth has been found to answer the purpose very satisfactorily. The application of this principle in case of old walls has been recently attempted by a gentleman, but I am not in a position to vouchsafe its thoroughness or its success.

The wall is stripped of its plaster into two lines, say 9 inches above the plinth and again 4 or 5 feet above the plinth. The area between these two exposed lines is first exposed to the action of the sun and afterwards plastered with Portland cement. The exposed portions are meant to act as outlets for damp and provided with ventilators. I doubt if this would stand any fair test.

Where dampness is due to rain beating against the

wall I would remove all plaster and stone composition in thin coats. Where dampness is caused by the entrance of rain water into the body of a wall from the roof I would recommend repair of the leaks through which rain water finds its way into the wall and diversion of the drain of the roof, if possible and economical.

HOW TO HANG CANVAS WALL COVERING.

The New Art jute canvas wall hangings, or "burlaps," as they are sometimes called, for decorative purposes have reached such a state of perfection that they are destined to become as popular as any other medium used by decorators. After having gone through a period of many experiments by the decorators themselves—who for some years back have had to contend with the many imperfections of the raw material, in the coloring of the material as well as its application—a condition has been reached where the manufacturer has now placed on the market a specially prepared burlap that has not only an even texture and uniform dye, but it has also a coating of sizing on the back whereby it is practically as easy to apply burlaps to the wall as it is to apply the ordinary wallpaper. There is not the latitude, however, in the quality of workmanship when hanging burlaps as there is in hanging of wallpaper. There is only one way to put it up, says the London Decorators' and Painters' Magazine, and that is, of course, in a first class manner, and therefore the best class of workman only should be entrusted with the responsibility of applying this material. The foreman should select a man who is noted for his careful attention to the details of good measurement and cutting to advantage, as it will soon be discovered that it is not quite so simple a matter to cover up bad work in measuring, cutting or trimming, with a patch here and there, as it is with the ordinary patterned wallpaper.

Burlap for decorative use is now made in all widths under various brands, from 36-in. up to 108-in. It is put up in rolls of from thirty to fifty yards long. It can be obtained in a great variety of colors and finishes as well as textures. The most popular finish is the dyed colorings, which are especially adapted for all sorts of background purposes, and can be used to advantage in libraries, smoke-rooms, dining-rooms, dens, art galleries or halls. It is also to be obtained in painted, lacquered, illuminated or oil-stained. It can be used to very good advantage in the natural color of the burlaps, and has been very successfully used on walls of art galleries for the purposes of exhibiting etchings, photographs, water colors, Indian relics and oil paintings because of the plain ground from which all lines are eliminated that might clash with the lines of the picture.

For special effects or, for various reasons which we will take up and describe later, it is desirable to use the natural color or preferably the bleached which forms a better ground, and after material is in position, the frieze may be colored, stained or decorated. When properly handled burlap lends itself admirably to staining and decorating by either stencil or hand work, the fact is the introduction of burlaps has enabled the decorator to be somewhat independent of the print manufacturer, as it is possible by the use of the stencil process to produce designs and colorings specially appropriate to the apartment wherein they are to be placed, and notwithstanding the fact that it is so nearly perfect, burlaps as a decoration is yet in its infancy. Great things will yet be done on burlaps, that it will be impossible to produce upon any other surface. Not only has burlaps as a decoration made rapid strides in popular favor on its own individual merits, but its success in conjunction with other materials has been marked, especially when used in conjunction with old effects or other applique ornaments.

While it would be a great pleasure for the writer to take up space and time in the description of the various decorative possibilities, it is his wish to make the present article of as much practical value as it is in his power to do. He will therefore leave the fancy work for some future article, and devote the present entirely to a description of the "How to do it" part of the work.

The walls should be first prepared by the removal of all the old paper or distemper which may have been left on from some previous work. All large cracks should be properly cut out and filled in. All of the wall surface should then be rubbed down and properly sized. Reduce all protruding spots by rubbing with pumice-stone. The sizing consists of the ordinary glue used in the usual way by soaking first, and the melting and thinning as is the case with ordinary wallpaper, with the possibility of, in some cases, using a little black treacle, Venice turpentine or brown sugar to make the size more adhesive and less brittle. It is sometimes desirable but not absolutely necessary to line the walls with a good stout lining paper. The burlap manufacturer produces a lining fabric for this purpose, which is cheap and far superior to paper. Lining paper should be hung horizontally, or contrawise the hanging of the wall covering. This will prevent any shrinkage that is liable to occur with the best of materials. Aside from this precaution, it is sometimes desirable to run a strip of water color about 1½ in. in width from the ceiling to the floor wherever a joint is to be made. This takes a little more time but it pays in the end, because in the event of the workmen making a poor joint a slight opening might remain, if it is only the width of a hair-line it will show when the light shines directly on it. It can be specially noticed at night when the conditions are such that the artificial light is usually thrown directly upon the walls from a centre chandelier, which light is sure to discover any imperfections of this kind, while in the daytime the light coming from one end of the room, as it usually does, it gives only a side light which will cast shadows on the joint and therefore disguise any defect similar to the above description. There is a well-known brand of burlap on the market which is absolutely guaranteed not to shrink.

In the measuring and cutting of burlaps the method is no different than that employed in measuring and cutting wallpaper, the room being measured to ascertain how many lengths it will require, the same being cut about 3 in. longer than the actual measurement, to allow for difference in the height of the walls at different parts of the room. In hanging we recommend to use the lengths as they come off the roll, reversing every other length, so as to get the same edges together, thus preventing shading. With the prepared burlaps it is usual to trim the edges, which is done with straight edge and sharp knife. Be sure and keep the knife very sharp. It is pasted in the usual way by laying the burlap face downwards on the table and pasting the prepared side.

When placing the burlaps on the walls great care should be taken not to pull or stretch it in any way as it will yield very readily, as it will as readily shrink up again to its original position. If in accommodating any uneven condition of the wall it becomes necessary to stretch the burlaps even slightly, to obtain a perfect butt-joint, strike with the open hand some 6 in. or 8 in. back from the joint (while in the act of hanging) the stretch necessary takes place at a distance some 6 in. from joint and the adhesiveness of the intervening space prevents its returning.

In hanging the pieces over the doors and windows I would specially caution the careful workman not to hang these pieces horizontally, as it is very tempting to do to save time, as the difference in the direction of the weave of the material will cause it to appear as a different shade and will thus mar an otherwise good job. I find it advisable to do the door and window tops as I progress around the room instead of leaving them to do after all of the long lengths are put up, which is the invariable custom with the average workman.

FOUNDATIONS ON QUICKSAND.*

Meriden lies in a valley between high hills. In the valley, which is claimed by some to be the original bed of the Connecticut River, is a soil which consists of sandy loam, a little gravel and plenty of quicksand. Most of the buildings in this valley rest on the skin which is found at various depths below the surface, and here the Meriden Gas Light Company bought a 300 by 500-feet meadow lot adjoining its works on which to erect a new holder. Careful borings were made over a section 120 ft. wide by 250 ft. long to determine the thickness of the gravel, if any, and its distance below the surface. To the west of this section, and 25 feet distant, runs a shallow brook, 20 to 30 feet wide—shallow except in freshet time. About seventy-five tests were taken, and the result laid out and plotted into curves, so that the most desirable place for the site might be located. The top material was a sandy loam, evidently a silt deposited from the overflow of the brook when in past years it was not so confined; the next a good gravel, but very thin; below that a quicksand of unknown depth. At a few points the gravel was found as near as 2 feet from the surface and 2 feet thick, while at the others it was 8.5 deep and only 0.4 thick, shading off to nothing. The average depth, however, taken from the boring stations, was 5.5 ft. deep and 1.2 ft. thick. A boring of 50 feet taken in the centre of the site showed 42 feet of quicksand and still more below.

On such materials it was decided to construct the foundation and erect a steel tank-holder, to be 115 feet in diameter and 103 feet high; holding 700,000 feet of gas in three lifts. The weight of the ho'der to be 475 tons and the weight of the water to be 8,625 tons or a total of 9,100 tons.

As the work of excavating progressed and the gravel was exposed, there was found a clearly defined depression diagonally across the pit, as if at some time the brook had flowed that way; for logs and trunks of trees were found together with a quantity of brush. Through this depressiou the gravel was very thin, and in three places the quicksand was entirely exposed—the first, a space 10 by 15 feet; the second, a space 4 by 12 feet; the third, a space 3 by 15 feet.

Hardly had the whole of the loam been removed when a rain came, followed by a heavy freshet, overflowing the meadow and deluging the pit. When the water had subsided it was pumped out in 8 hours with a 4-inch centrifugal pump and a 7½ horse-power motor, though the water was ten feet deep in some places. The freshet convinced the company more than ever that in erecting a holder it would be advisable to make the top of the foundation above high-water mark, which in this case would mean a fill in some spots of 12 feet, with an average of 8 feet, and the steel tank would be 2.5 feet above the level of the meadow.

At this point a difficult problem was confronted. Meriden topographically is on high hills and in a sandy valley; good gravel is a very scarce article. Four miles away, on the line of the railroad, is a large, poor gravel bank, and two miles in another direction is a small, good bank; but with all the teams that could be procured it was not possible to haul the material as fast as it was needed; and it was expensive—one dollar per yard—delivered. It was evident that other and good material must be obtained in large quantities. On the line of the railroad three miles away is a large trap-rock quarry. Refuse in the shape of iron-stone, soft rock and some dirt is accumulated in large quantities. It was believed this stone would mix well with the material which was on hand and could be purchased after it had been passed through the crusher to a 1½-inch size, at 60 cents per yard delivered, and in quantities up to 150 yards per day. About 50 yards of gravel and 50 yards of clean, sharp sand could also be procured each day, and as much ashes from the works as there were teams to put on it.

The question of piling was considered, and by some might seem the only wise plan under the circumstances, but after consulting the leading local builder who had worked on this quicksand for thirty years and had erected some very heavy factory buildings on it, it was thought best to put in a combination filling of the above-named materials.

The quicksand is found hard packed and not easily dug, unless water is allowed to mix freely with it. A'though the excavation was in places much below the level of the brook, little water was encountered, and quite as much came from the land as from the brook side. By keeping the bare spots well drained the men could work on the quicksand with a degree of ease without sinking in very deep; the less it was disturbed, however, the better off they were. Over these bare spots it was decided to lay plank close together lengthways of the holes, and upon these 8 by 10-inch timbers, 8 inches apart, crossways of the holes. The filling between the timbers was of pieces of bricks and old retorts broken up fine, that being the best material at hand just then. One of the bare spots being narrow and long, the surface was covered with large flat stones, the smaller spaces being filled in with fire-bricks and coarse ashes.

While working at this low level a pump was run night and day; also from these quicksand spots a 4-inch tile drain was laid to a central point to facilitate drainage and keep the mass from becoming spongy while the tamping was going on and each course of filling was laid.

Until the whole surface approached a level no roller could be used, but everything put in was thoroughly rammed and sprinkled. The layers were about 3 inches thick over the whole surface. When the valleys were evened up a two-horse 4,000 lbs. roller was put on, and as the thickness became greater this roller was increased in weight to 6,500 lbs., requiring four horses. When the level of filling had been raised above the natural water level the pumping was dispensed with over night, allowing the foundation to be saturated, but it was pumped out again in the morning.

Near the centre of the foundation a loose brick well was built up, into which the water ran as the foundation was successively wetted, and from which it was pumped to the brook. There were some high knolls of gravel not over 3 feet under the surface. It was thought at first that the 5-feet concrete side wall foundation might rest on these, but further consideration convinced the company that this was not advisable, as part of the foundation would rest on natural gravel, while most of it would be on filled ground, so the whole level was raised 1 foot to allow of the same kind of cushion underneath the whole structure before the 5-feet circle was started.

* From a paper by Mr. C. A. Learned, read before the New England Association of Gas Engineers.

The layers spread each day over a diameter of 125 feet were about as follows:—125 yards of quarry refuse, 40 yards of good gravel, 50 yards of works' ashes. Towards the end of the work the ashes were exhausted. Near by was a bank of 500 yards of sand, and from this was taken what was needed to make the top dressing under the concrete, spreading on the stone, washing it in and carefully rolling. Toward the end the roller worked night and day.

Near the edge where the wall of concrete was laid, there was a space that could not be rolled, but had to be filled and tamped to a depth of 4 feet. In order to make sure that this portion was as solid as the centre, a round tapering bar 5 feet long was driven into the

PAIR OF SEMI-DETACHED HOUSES ON A NARROW SITE, TORONTO.
F. F. SAUNDERS, ARCHITECT.

main foundation several times. Seventy blows on the average were required to drive it 4·5 feet, and the outside ring was tamped until it equalled the above test.

The amount of material removed approximated 2,900 yards. The work of excavating and filling ready to begin concreting took twenty-two days, and six days more were required to fill in around the great circle after the concrete wall was 4 feet high. This, however, did not delay the concreters in their work. The filling was as per the following amounts:—Quarry stone refuse, 1,780 yards; gravel, 680 yards; sand, 310 yards; ashes, 1,100 yards; total, 3,870 yards.

On this foundation was laid 630 yards of Portland cement concrete, in the following proportions: 1 of cement, 2½ of sand and 5 of stone. The size of stone was 1¼ inch and smaller. A great circle of concrete 4 feet wide and 1 foot thick was laid 5 feet below the finished top. On this circle was laid a ring 3 feet wide at the bottom, tapering to 2 feet 9 inches wide at the top, and 3 feet high; resting on the ring was laid, over the whole diameter of 118 feet, a layer 1 foot thick, trued to prefect level and plastered smooth. This work was accomplished in eighteen days, and in a most satisfactory manner, a local engineer taking the job at 4.90 dols. per cubic yard laid. As soon as the foundation was ready the iron men were on the ground, and the holder was erected complete in a week less than the specified time of four months.

In order to prevent the action of the brook eating away the bank near the holder, a stone wall 7 feet high was built to the level of the holder foundation and 400 feet long, protecting also a new purifier building near the brook. City water was used to fill the tank, as the brook water contained acids. It took three and a half days to fill the tank, which holds a little over 2,000,000 gallons. Before the water was put in careful levels were taken on eight points of the foundations. After filling levels were again taken, and there was not the slightest settlement.

The Montreal Silicate Brick Company, has been incorporated,

BY THE WAY.

The present popularity of all kinds of athletic sports calls for the erection of tiers of seats for the accommodation of the enormous crowds of on-lookers. That great case should be exercised in their construction is evidenced by the accident which took place in Glasgow recently, when 21 persons were killed and 250 injured by the collapse of the "Grand Stand" during a foot-ball match.

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The Chinese have been demolishing walls outside the Summer Palace at Pekin, and selling the bricks to the various Legations where building is going on, the Ministers being in ignorance of where they were obtained from. But Nemesis sometimes overtakes even the "wily Chinee," says the British Clayworker, and investigation has led to the arrest and punishment of six of the offenders. The Legations ought now to be invulnerable, since sacred bricks have been employed in their fortification. When we come to reflect on the matter, however, the Ministers must be an extremely ignorant body not to know a new brick from an old one—perhaps they winked at Master John whilst the transference to their own abodes was taking place, bricks being particularly scarce in Pekin just now.

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A verdict for £150 was recently given by an English jury against the proprietor of Her Majesty's Theatre in London in favor of a person named Davies who was injured by slipping from a 6 inch step while hurriedly making his exit from the building. The Builder points out that this should serve as a warning to architects not to plant a door on the top of a 6 inch step so that the fact of the existence of a step is only visible from one side of the door.

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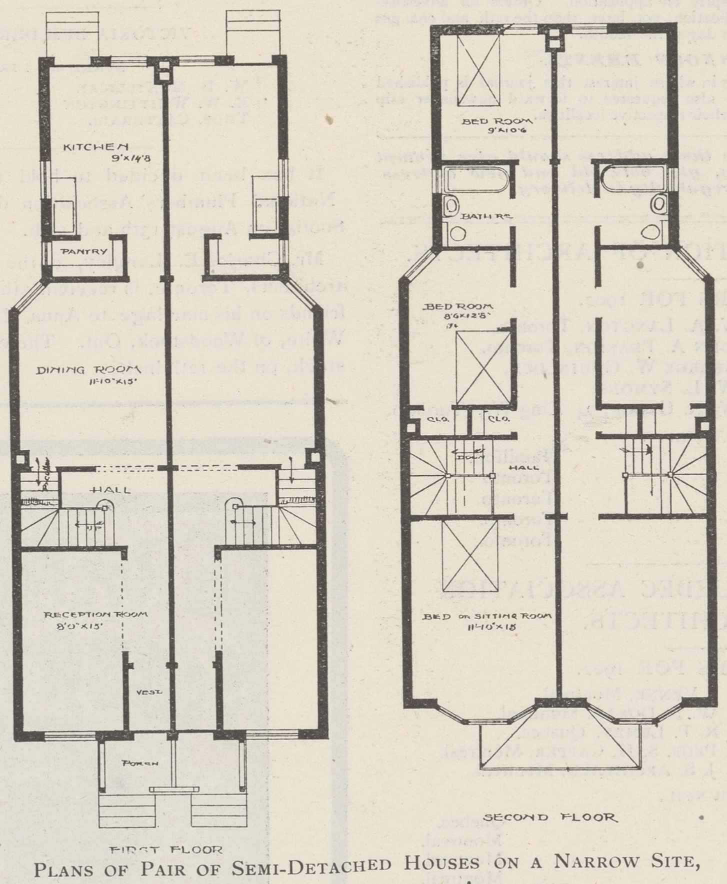
Some twenty five years ago a friend of Mr. Aston Webb's wrote a little ditty which described the progress of a young man who started as office boy with a builder and passed through the various ranks until he became an architect. When he reached the position of clerk of works the ditty described him thus:—

When builder's work he found it tame,
So clerk of works he next became;
The work was less, the wages more,
And he liked to boss the contractor.
He wore a two-foot rule and suit of grey,
And now he is a F. R. I. B. A.

× × ×

The Monetary Times contributes the following to the long catalogue of unreasonable demands of the labor unions:—"We know of a case in an Ontario city last autumn where a block of brick buildings was in process of erection, and some bricks of peculiar wedge-shaped form had been ordered from a brick works to be ground to pattern by machinery. The architect was on the structure one day, and a delegate from a labor union came to inform him that these tapering bricks must be ground down by hand—the Union said so. "But," said the architect, "there are not enough bricklayers in the city to contruct before the snow comes the buildings already under contract; why do you want to delay by putting hand-work on these bricks?" There was no answer but the irrational one, that it was the Union's ultimatum. The architect, who is not a patient man, ordered the walking delegate off the works, using a Shakespearean phrase, and declining to be bullied. But, next day, not a man was at work on the block, bricklayer, carpenter, or plumber. The architect, consistent even in his wrath, went to look for non-union men to complete the walls and other work, when the owner of the building, himself a large employer of labor, interposed and accepted the Union's terms rather than have a strike in his own works.



Plans of Pair of Semi-Detached Houses on a Narrow Site, Toronto.—F. F. Saunders, Architect.

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Much of the architectural terra-cotta of the day in the opinion of a writer in the British Clayworker, is decidedly over-finished. Apart from slovenly and careless work says the writer, two grades only of "finish" are possible — right finish, or the full rendering of the intended expression; high finish, or the rendering of vivid expression. These, and indeed all the best effects, are oftener got by rough than fine handling. Excellence in architectural terra-cotta, particularly in ornament, is not attained so much by the cutting of the form, it is rather in the ultimate effect of the mass. The correct finish is about that of a modelled piece, made in the same material employed in bulk on the building, after leaving the architectural modeller's hands, the presser or mould-maker's shop. After the mould is made, the presser or finisher, by the excessive use of sponge, leather, knife and busk, destroys all the life and spirit formerly existing in the work, to say nothing of the false surfaces, which readily flake, on the faces of the wares, worked up by excessive finishing. Look at a piece of direct work; work straight from the architectural modeller's hands, without the intervention of mould, presser, or finisher. Note this in a building, side by side with pressed-up wares; if the modeller is worth his salt there will be life and spirit in the work, attributes too often lacking in the doubtless more highly-finished samples of the moulder's art!

—THE—

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It has been decided to hold the annual convention of the National Plumbers' Association of Canada at Halifax, Nova Scotia, on August 13th and 14th.

Mr. Charles E. Langley, of the firm of Langley & Langley, architects, Toronto, is receiving the congratulations of numerous friends on his marriage to Anna M., second daughter of James White, of Woodstock, Ont. The ceremony took place at Woodstock, on the 12th inst.

EXHIBITION OF ARCHITECTURAL PHOTOGRAPHS.

By the courtesy of the Toronto Architectural Eighteen Club, the Toronto Chapter of the Ontario Association of Architects has the Toronto photographs, which formed a portion of the A. L. A. Exhibition, now on exhibition in the rooms of the Association, 94 King St. West, where they will be hung for the next ten days. The Eighteen Club has also loaned the Interesting Catalogues of the Philadelphia T Square Club covering the past twelve years, which will also be on exhibition at the O.A.A. rooms.

NOTES.

Robert McCausland Limited, the well known manufacturers of stained glass have recently removed to new premises specially designed for their use, at No. 86 Wellington street, West, Toronto.

Frosting upon glass may easily be accomplished by mixing magnesium sulphate (Epsom salts) with beer. Apply by means of a sponge. Bind it upon the glass by running over it a wash made of gum arabic and water.

Putty may readily be softened by rubbing over it a strong solution of caustic soda, which should be applied by means of an old paint brush. Moistening the putty with spirits of salts will also rapidly turn it soft, when it may readily be removed.

Be sure you have figured accurately on a job, allowed yourself fair pay for honest work, counted the cost of all material used, and taken into consideration every expense incurred, before you name your price for the work.

Oak and cherry woodwork may have Indian yellow walls with a deep Indian yellow frieze, and Indian yellow cornice, the ceiling of light Indian yellow, with the upholsterings of the same tone, or cardinal red, olive or blue, and the draperies of heliotrope.

An excellent hard drying putty for exposed situations, as skylights and roofing work, may be prepared by mixing whiting with boiled linseed oil, adding about 1/6 of its weight of powdered litharge. Mix only sufficient for immediate use as it rapidly hardens.

A MASONRY SPECIFICATION.

The Committee on Masonry of the American Railway Engineering and Maintenance of Way Association, in a recent report to that body, submit the following general definition of masonry :

"Masonry, in its widest sense, includes all constructions of stone or kindred substitute materials, in which the separate pieces are either carefully placed together, with or without cementing material to join them, or, if the pieces are not separately placed with care, are encased in a matrix of firmly cementing material."

The committee also submit the following form of specification :

DESCRIPTION OF STONE MASONRY.

All stones used for masonry shall be sound, durable, well seasoned from sources approved of by the engineer, and shall be laid on their natural beds.

Mortar, for laying up stone masonry, unless otherwise expressly stated, shall consist as follows: Either one part by volume measured loose of approved Portland cement to three parts of good, sharp sand, or one part of approved natural cement to two parts good, sharp sand, all to be very carefully measured and mixed, and to be used within one hour after mixing, and always before it shall have commenced to set.

Mortar, for pointing, shall consist of one part Portland cement to one or two parts of sand.

(Space for additions.)

Finished copings, parapets, bridge-seats and other finely dressed special stones—Work that comes under this head shall be of selected stone, of the best quality, free from defects, shall be very accurately cut, being finely bush-hammered where called for, and as per plan and dimensions given. To be laid to ⅜-inch joints.

(Space for additions).

FIRST-CLASS MASONRY.

First-class masonry will be laid in Portland cement mortar, in regular courses, each stone being carefully cleaned and dampened, if desirable, before setting. The face stones shall be rock faced, with edges pitched to a straight line, and no projections exceeeding 3 inches. A draft line, 2 inches wide, shall be cut at each angle in the masonry. The beds throughout and the joints for 12 inches back from the face shall be dressed to lay to ½-inch joints. No course shall be less than 12 or more than 30 inches in thickness except the coping, and the thickness of any course shall not exceed the course below it. Stretchers shall not be less than 3 feet long, and not less than 18 inches wide, nor in average width than 1¼ times their height, and at no single place less in width than height.

Headers must not be less than 4 feet long, where the wall is of sufficient thickness, and the majority shall exceed that length. Where the wall is not over 5 feet thick, they shall extend entirely through the wall. Headers will extend at least 20 inches beyond the width of the adjacent stretchers. The usual arrangement shall consist of headers and stretchers, alternately arranged, so as to thoroughly bond together the face stones and the backing; for rare exceptions, two stretchers will be allowed to one header, by special permission, to cover each such case. The stones of each course of the face must break joints at least one foot with those of the course below. No hammering will be allowed on any stone after it is set. Each stone must be set upon a full bed of fresh mortar, the broadest bed down, and brought to a firm and level bearing without spalls or pinners.

BACKING.

The backing shall consist of large-size, well-shaped stones laid in full mortar beds and breaking joints so as to thoroughly bond the work together. The spaces between the larger stones shall not be over 6 inches in width and shall be thoroughly filled with small stones and spalls laid flat, and all spaces flushed with mortar or good cement grout. The courses shall correspond with the face stone, but may be

made up in part by two thicknesses, providing no stone less than 8 inches thick be used. In cases approved by the engineer, satisfactory Portland cement concrete with large stones embedded in the concrete may be used for backing.

SECOND-CLASS MASONRY.—Second-class masonry shall be laid in cement mortar. The face stones shall be rock faced, no projections over 3 inches, edges pitched to a straight line, shall have parallel beds and rectangular joints. The beds and joints for 8 inches back from face shall be dressed to lay not over ¾-inch joint. The stones need not be laid up in regular course, but shall be laid level on their natural beds, shall be well bonded, having at least one header 3 feet 6 inches long to every three stretchers with joints well broken; no stone shall be less than 8 inches thick, and no stone shall measure in its least horizontal dimensions less than 12 inches nor less than its thickness.

BACKING.—The backing shall consist of well-shaped stones, not less than 6 inches thick, and of which at least one-half shall measure 3 cubic feet, to be laid in full mortar beds, with joints well broken, well bonded together and with the face stone. All spaces to be thoroughly filled with small stones and cement motar.

THIRD-CLASS MASONRY.—Third-class masonry shall be laid dry or in mortar, according to the direction of the engineer. It shall consist of good quarry stone, laid upon the natural beds, and roughly squared on joints, beds and faces, the stones breaking joints at least 6 inches; the wall shall be bound together by headers, occupying one-fifth of the area of the face of the wall front and rear, and extending through walls 3 feet or less in thickness; no stone shall be used in the face of the wall less than 6 inches thick or less than 12 inches on the least horizontal dimensions.

Messrs. Darling Bros., of Montreal, manufacturers for Canada of the Webster feed water heater and Webster system of steam heating, have just issued a new catalogue, a copy of which they will be pleased to furnish on request to anyone interested.

MISTAKES IN HIS NEW HOUSE.

O. M. Weand, a railroad contractor, of Reading, Pa., has just finished building a house for himself and to commenorate the event, has published an illustrated pamphlet of fifty or more pages containing the criticisms of leading citizens. The title of the book is "The Mistakes I Made in Building a House." Following are some of the criticisms of his friends:

"Of course, you are building the house, but if it were mine, I would run an open porch around the corner so as to connect the two porches."

"I would prefer one large window in the second-story front, instead of the double window."

"You'll make a mistake if you don't pebble dash the exterior".

"You better run the 13-inch walls all the way up. It gets pretty windy out here sometimes."

"I think the ceilings are two low."

"My!" How small the rooms are."

"You ought to be on the other side of the street."

"If it were my house, I would prefer to have the cornice several inches higher."

"By all means put a double line of boards on the first floor. It keeps the cellar dust from coming through."

"Those chimney tops look like tomb-stones."

"The lawn steps should have been immediately in front of the main entrance."

"Why didn't you set the house in the middle of the lot?"

"Personally, I prefer steam heat to the hot water system."

The Toronto Master Painters' Association recently elected the following officers:—President, J. J. O'Hearn (re-elected); First Vice-President, J. W. Knott; Second Vice-President, Charles Davies; Secretary-Treasurer, Stewart N. Hughes; Executive Committee, J. M. Faircloth, John Alexander, E. J. Livingston, James Casey and Charles Reeve.

STONE AT THE ROYAL EXCHANGE, COLONIAL EXHIBITION.

The visitor interested in stone is struck by the fine display of Canadian building stones, says The Quarry, in an article referring to the above Exhibition, and then goes on to say :—"In New Brunswick freestone and sandstones suitable for grindstones are found in abundance in the carboniferous rocks. Grindstones and building stone are now quarried at Woodpoint Quarry, near Sackville, and at Cobourg Quarry, near Bay Verte, and work has been done in the parish of Dorchester. The industry has also attained considerable importance in the north, about Newcastle, in Northumberland County, and Stonehaven and Clifton, in the Bay of Chaleurs. From the French Fort Quarry, near Newcastle, much sandstone of a superior and durable quality has been taken. It has been used in the construction of the Langevin Block, at Ottawa, and in other works of importance. Some grades of it are admirably suited for the manufacture of stone for wood pulp grinding.

The freestones of Clifton and Stonehaven are said to be less suited for building.

Granite from Hampstead, Queen's County, known as Spoon Island granite, attracted early notice, although the quarrying industry has not become very extensive there. The red granites of St. George, Charlotte County, are better known, and the latter town has become the seat of somewhat important works. The stone has been used in many buildings, both public and private, and in bridge work. It is also excellently adapted to monumental work, and a considerable industry is carried on in cutting and polishing monuments, columns, &c., by water power.

Limestones are abundant throughout the province, but the remarkable purity of the deposits near St. John, with the facilities afforded for working them, have produced an important industry. Lime is sent to many adjacent ports.

Of building stones there is in Quebec a great variety. Fine granite, both of red and grey colors, is found at many places in the Eastern Townships, and is extensively worked in Stanstead county. Marbles occur in the crystalline series of the same district, especially about Stukely, in the Sutton mountain range, and also as a part of the Archæan of the Ottawa area ; while the limestones of the

Trenton, Black River, and Chazy formations are extensively quarried at many places for building stones, as well as for the manufacture of lime and cement.

Extensive slate quarries are found in Eastern Quebec, at Melbourne and Danville.

Ontario abounds in building stones of many kinds and often of excellent quality. The old crystaline rocks of the Laurentian country yields granites and gneisses, generally red or reddish colors, as well as marbles like those of Arnprior and Barrie. Limestones and Sandstones are quarried in a great number of places in the southern and thickly inhabited parts of the province, chiefly for local use, but also for the supply of the larger cities and to a small extent for export. Clays and shales of different kinds largely employed in making bricks, drain-tiles, terra-cotta, &c. The manufacture of lime and hydraulic cement also constitute important industries, deposits of shell-marl ane being utilized to a considerable extent for the last named purpose, It will be observed that, taken together, materials applicable to purposes of construction represent a large proportion of the total mineral output of Ontario.

In concluding this article we cannot avoid commenting upon the somewhat unsatisfactory nature of the official catalogue of this exhibition, at least so far as the stone exhibits are concerned. Even the fine display of Canadian building stones, particulars of which have been given above, is dismissed in the catalogue in a few lines, and many of the other specimens are not even mentioned. As this is one of the few things for which a charge is made, it seems a pity that it should not form a more complete record of this most interesting exhibition.

An agreement has been reached with the structural iron workers by which the strike in Toronto is at an end. The new rate of wages is from 27½ cents per hour for first-class to 22½ cents per hour for inferior grades of workmen.

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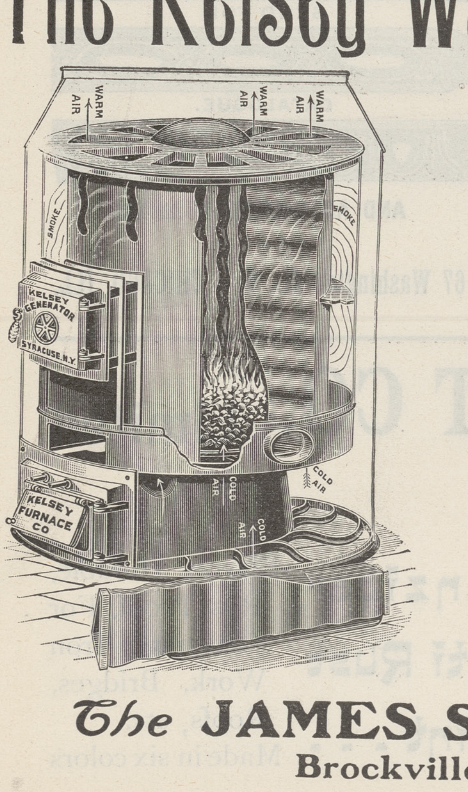

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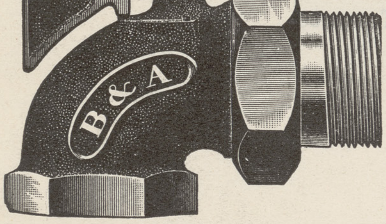

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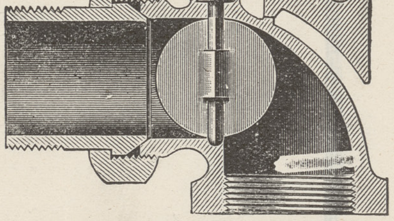

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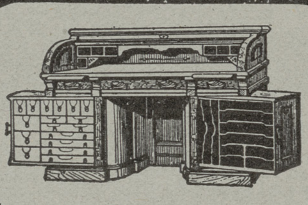

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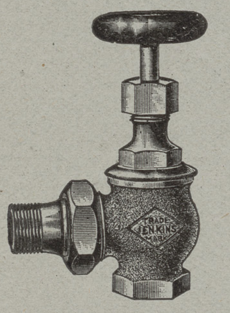

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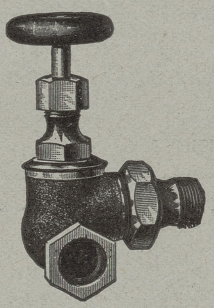

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